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Some New Brachiopods and Gastropods from the Devonian of Iowa.

BY CARROLL LANE FENTON.

I.—EXPLANATION.

For some time I have had in my collection representatives of various species occurring in the Cedar Valley Stage or the Hackberry Stage of the Iowa Devonian. These forms, I have been sure, represented new varieties, and in some cases, probably new species. It is some of these forms that I desire to discuss in this paper.

The following is a list of the species here considered, with locality of original description.

Strophonella reversa Hall. *Strophodonta reversa* Hall, Geology of Iowa, Vol. I, part 1., page 494, Plate 3, figure 4, a, b, c, d.

Douvellina arcuata (Hall). *Strophodonta arcuata* Hall, Geology of Iowa, Vol. I, part 1., page 492. Plate 3, figure 1 and 2.

Atrypa reticularis (Linnaeus). *Anomia reticularis* Linnaeus, Systema Naturae, 12th edition, Vol. I, page 1132. (*A. reticularis*, in Hall, Geology of Iowa, Vol. I, part 1., page 515. Plate 6, figure 6, a, b, c.)

Spirifer Whitneyi Hall, Geology of Iowa, Vol. I, part 1. page 502. Plate 4, figure 2, a, b, c e.

Spirifer cyrtinaeformis Hall and Whitfield. 23rd Annual, New York State Cabinet, page 238. Plate II, figures 21-34.

Spirifer orestes Hall and Whitfield, 23rd Annual, New York State Cabinet, page 237, Plate II, figures 16-20.

Floydia concentrica Webster. Iowa Naturalist, Vol. I, page 39. (See also *Naticopsis gigantea* Hall and Whitfield, 23rd. Annual, New York State Cabinet, page 238. Plate 12, figures 8-10.

All of the forms here noted occur above the Cedar Valley Stage, while one, *Atrypa reticularis alta*, also is represented in this formation. As there is considerable difference of opinion as to the

geologic age and proper terminology for the shaley limestones and clays surmounted by limestones that are here referred to as "Hackberry," I therefore consider the following correlation of terms advisable.

Webster	Iowa Geol. Survey	Fenton	U. S. G. S.
Hackberry Group	Lime Creek Stage	Hackberry Stage	Lime Creek formation
Upper or Owen Horizon	Owen Sub-stage	Owen Sub-stage	
		Acervularia Zone	
		Naticopsis Zone	
		Idiostroma Zone	
Middle Horizon	Hackberry Sub-stage	Spirifer Zone	
Lower Horizon		Striatula Zone	
Genesee ? ? Stage	(blue, argillaceous shales, unfossiliferous, Hackberry sub-stage)	Genesee ? ? Stage	? ? ?

Zone Division — — — Sub-stage Division — — — — —

..... Indicates Slight Distinction But No Division-

This same formation has variously been considered as Hamilton, Chemung, and Portage, and the forms described in the 23rd Report of the New York State Cabinet were considered as Chemung. To my mind, however, there can be no doubt that this formation is a distinct stage.¹

II.—DESCRIPTION OF VARIETIES.

STROPHONELLA REVERSA *gravis* nov. var.

Shell semielliptical, width about equal to or less than the length, hinge line slightly or not extended beyond the width of the shell. Ventral valve convex near the beak, flattened along the hinge line and deeply concave below; shell abruptly deflected near the margin. Dorsal valve slightly concave near the beak, abruptly bent downwards below the center. Area common, that of the ventral valve being usually the wider. Surface marked by strong and heavy dichotomizing plications, simple near the beak, also frequently bearing heavy lines of growth. Surface of shell punctate.

Interior of ventral valve marked by quite deep muscular impressions; vascular impressions large, flabelliform or double ovate, the

¹ Since sending this to the printer, Webster has endorsed and accepted the zone divisions and names that I note here.—C. L. F.

latter most characteristic, defined on their margins by a thickening of shell, while deep, irregular, linear impressions continue to the margin of the shell. Cardinal process prominent, bilobed, with a deep impression for the "horns" of the dorsal cardinal process.

This variety differs from the *Strophonella reversa* of Hall in its generally heavier character, greater coarseness of the shell, greater height of the dorsal valve and greater length in proportion to the width. In the interiors of both valves this coarseness and heaviness is very apparent. It also differs from the true *Strophonella reversa* in that the valves are seldom produced along the margin to any extent, as is frequently the case in the form described by Hall.

Cotypes:—Set 901, collection of C. L. Fenton, Spirifer zone, pits of the Rockford Brick and Tile Company, Rockford, Iowa.

DOUVILLINA ARCUATA maxima nov. var.

Shell semielliptical; hinge line barely or not equal to the greatest width of the shell. Ventral valve hemispheric very gibbous near middle; beak slightly to quite pronounced. Dorsal valve quite concave, but not so deeply as in the typical species. Area common, with that of the ventral valve the larger, and bearing deep vertical striae. In all specimens examined by me there is no foramen.

Surface of shell marked by strong striae "or which sometimes consist of a few strong ones near the beak, bifurcating below, while the general character of surface marking is that of strong, sharply elevated striae with three, four, or five smaller ones between" (Hall, original description). I have noted this characteristic, and it is shown very well in specimens in a set from Rockford in the collections of the University of Michigan. As a rule, however, the striae on the surface of *maxima* are less pronounced, and more inclined to be simple than in the typical species. The interior of the shell does not differ greatly in general markings from the species *arcuata* of Hall, but is considerably heavier and coarser.

This variety differs from *Douvellina arcuata* (Hall) in the larger size attained, the greater width in proportion to length, the heavier character of the shell and greater thickness. It is generally a more robust form, and while not differing greatly in a written description differs much in the specimens. A comparison with the figures given and the figures accompanying Hall's description of *Strophodonta arcuata* will serve to bring out more plainly these differences.

This variety is much less common than the typical form, particularly at the exposures in the Rockford district. I have found it more pronounced at the Hackberry Grove exposure.

Cotypes:—Set 897, collection of C. L. Fenton. Spirifer zone, Hackberry Grove, Cerro Gordo County, Iowa.

ATRYPA RETICULARIS **alta** nov. var.

Young:—Shell depressed, suborbicular in extreme young, sinus and mesial fold becoming developed earlier, however, than in other types of the species *Atrypa reticularis* that I have examined.

Adult:—Shell gibbous. Hinge line rather straight, and almost equalling the width of the shell. The ventral valve becomes very gibbous as the age of the shell advances. Sinus deep and abrupt; mesial fold high but not well defined. The beak of the ventral valve becomes recurved in aged specimens and finally incurving over the beak of the dorsal valve. The plications are fine, as are those of most of the Hackberry forms of *Atrypa reticularis*, though those of *alta* seem finer than those of the average form. The shell is marked by frequent lines of growth, usually of fine character.

Holotype:—Number 156, collection of C. L. Fenton. Spirifer zone, Hackberry Grove, Cerro Gordo County, Iowa.

Paratypes—Set 867, collection of C. L. Fenton. Spirifer zone of Hackberry, Rockford, Iowa. Set 863, collection of C. L. Fenton, St. Charles zone of Cedar Valley, Charles City Iowa. (Kelly Quarry).

This variety is quite distinct, and should not be confounded with *Atrypa rockfordensis* Webster, which also has a deep sinus but is of widely alate character. *A. r. alta* has much finer plications than *A. rockfordensis* and does not develop the wide expansions that are characteristic of the latter form. In the holotype of *alta* the mesial fold is well pronounced and bounded by slight folds in the shell.

SPIRIFER CYRTINIFORMIS **Helenæ** nov. var.

Shell small, sub-trapezoidal, with slightly convex dorsal valve marked by a practically undefined mesial fold. Cardinal area vertical or strongly inclined forward and occasionally backward, three-eighths to one half as high as wide in mature specimens, in young often not more than one-third as high as wide, divided by a large foramen and bearing vertical striæ. Surface of valves bearing from thirty-five or more rounded plications, with the central plication

of the sinus and the mesial fold dividing as in the typical form of the species. Sinus slightly to well developed but not usually well defined. In the holotype the beak of the ventral valve is slightly curved, but in many specimens, as the figured paratype, there is no trace of a curve.

This variety attains, on an average, a larger size than the typical species. The width of the area as compared with the height is about twice as great, and the sinus and the mesial fold attain greater development than in the species as described by Hall and Whitfield. The frequently inclined character of the area is also a point of considerable difference for the area of *S. cyrtinaformis* is regularly almost vertical. This variety is much more inclined to develop mucronate points than is the true species, especially in the young forms.

This species is apparently most unevenly distributed and of a very gregarious character, and the variety here described is no exception to the habit of its species. At the pits of the Rockford Brick and Tile Company I find the typical form much the more common of the two; at Hackberry the variety *helenae* occurs in proportionately larger numbers, particularly at the east portion of the exposure. At hills north and west of Rockford I find it predominating and at the Bird Hill exposure, on the line between the counties of Floyd and Cerro Gordo I find it almost replacing the typical species. In this characteristic it makes an interesting comparison with *Spirifer Macbridei* Calvin and *Gypidula comis* (Owen), both forms that are very gregarious in their habits.

Holotype:—Number 865, collection of C. L. Fenton. *Spirifer* zone, pits of the Rockford Brick and Tile Company, Rockford, Iowa.

Paratype:—Number 866, collection of C. L. Fenton. *Spirifer* zone, pits of the Rockford Brick and Tile Company, Rockford, Iowa. Collected by author.

SPIRIFER ORESTES **Websteri** nov. var.

Shell small or medium, considerably wider than long, and usually somewhat gibbous, and considerably extended on the hinge line, both in young and old specimens. Valves marked by strong and often coarse rounded or angular plications, simple on the sides of the shell, but bifurcating and occasionally uniting on the fold and sinus, where there are usually four plications. Mesial fold strongly

elevated in front both on small and large specimens. Ventral area low to moderately high, with the beak strongly incurved; foramen large. Surface marked by fine striæ running roughly parallel to the plications of mesial fold and sinus very strong; lines of growth frequent and strong.

This variety might perhaps be justly designated as a new species, as it is fully as distinct as many of the species of brachiopods that are accepted—for instance some of the *Atrypas*. In its true form there is no possibility for confusion with the true *Spirifer orestes* Hall and Whitfield, but the two intergrade to such an extent that for the present I designate the form *Websteri* as a variety.

The differences from the *Spirifer orestes* of Hall and Whitfield are in the greater size attained, the greater width in proportion to the length, the greater depth of sinus and correspondingly greater mesial elevation, the more pronounced character of both sinus and mesial fold, and the greater coarseness of the plications and the shell in general. The striæ seem fewer on the surface of the shell in specimens examined, but they do not differ in character from those of the true species.

Figure 26 shows a large and somewhat deformed specimen of this variety. Figure 27 a smaller, finer, and proportionately wider specimen with greater development of sinus and mesial fold. Figure 28 gives a detailed view of a portion of the dorsal and ventral valves of a considerable smaller specimen than the one shown in 26, and shows the coarseness of the shell, and the heavy lines of growth, magnified. Figure 29 is a magnified detail of a portion of the sinus of the same specimen used in figure 28, also magnified. This shows the heavy lines of growth interspaced by smaller, lighter ones. Figure 30 is an enlarged detail of the sinus of the specimen shown in figure 27. It will be noted that two of the plications on the sinus cease at the heavy growth-line or wrinkle. This same feature is shown, but less plainly in the small figure, 27. *Hederalla alternata* (Hall and Whitfield) is growing on the shell. Figure 31 is an enlarged detail from the dorsal valve of the specimen shown in figure 26. The portion shown is to the left of the sinus and mesial fold (right as shown in the figure) and shows a bifurcation of the plications. The plications on the right of the mesial fold are simple, and none of the other specimens in the cotypes show bifurcation except on the sinus and fold, as stated in the description. I am therefore inclined not to regard this as more than an aberration. Another interesting

aberration is shown in figures 27 and 30, where the sinus loses some of its plications at the heavy growth-wrinkle.

Cotypes:—Set 265, collection of Carroll Lane Fenton. *Spirifer* zone, pit of the Rockford Brick and Tile Company, Rockford, Iowa.

SPIRIFER WHITNEYI rockfordensis nov. var.

Shell of medium size, valves strongly convex. Ventral valve of holotype with sinus marked by eleven dichotomizing plications, mesial fold by eleven (or twelve?). Sinus concave near beak, but becomes strongly convex toward fore part of the valve; mesial fold very highly elevated. Surface of shell marked by about twenty-five plications on either side of the fold and sinus, plications finer than in the typical *S. Whitneyi* of the same horizon, but with comparatively wide spaces between. Beak strongly incurved over a low area bearing vertical striæ. Plications marked by fine radiating striæ. Hinge line and width of shell small. In the holotype the hinge line does not exceed the width of the shell.

This variety differs markedly from the species as described by Hall. The width is much less and the thickness of the shell much greater, the beak is much more strongly incurved, and the area much narrower. The dorsal valve is much more gibbous and much larger in proportion to the ventral than in the typical form. The sinus is very abrupt, and its convex character is very distinctive. The holotype, which is the only specimen in my collection that can be positively referred to this variety is somewhat larger size than the average *Spirifer Whitneyi*, and is apparently an aged specimen. It is considerably worn and bears borings of a *Cliona*, apparently *C. hackberryensis* Thomas. This variety is not to be confused with the mutant *S. whitneyi gradatus* described below.

Holotype:—Number 236, collection of C. L. Fenton. *Spirifer* zone, pit of the Rockford Brick and Tile Company, Rockford, Iowa.

SPIRIFER WHITNEYI gradatus nov. mutant.

Shell of medium size, with plications similar to the typical *Whitneyi*, as to number and arrangement, but considerably coarser and with the spaces between greater. Sinus broad, abrupt and usually deep and sharply defined. The mesial fold is regularly correspondingly high, and well defined. The beak of the ventral valve is sharply curved, the area correspondingly low. The hinge line is about equal to the width of the shell, though there is sometimes a tendency

toward an abrupt mucronate development. The surface of the shell is commonly marked by very heavy lines of growth.

This form quite resembles in shape the form from the Ouray illustrated and described in Bulletin 391 of the United States Geological Survey. It attains a size considerably larger than the typical *Whitneyi* of the Hackberry, and in fact any except those of the west, so far as I have had opportunity to examine. The general shape of the shell is similar to that of *Spirifer Whitneyi rockfordensis*, though the dorsal valve does not attain as great a development compared with the ventral, nor does the sinus depart from its regular form. The width of the shell in proportion to the thickness is considerably less than in the typical *Spirifer Whitneyi* Hall. The area is narrower and more curved, and the general appearance of the shell is heavier than the true species. There is considerable variation, and it almost appeared that some of the specimens of this form are transitional between *Spirifer Whitneyi* Hall and *Spirifer Whitneyi rockfordensis* of this paper. It has been inadvisable to select a holotype, due to variance in form. Cotypes, set 868, collection of C. L. Fenton, Spirifer zone, pits of the Rockford Brick and Tile Company, Rockford, Iowa.

The illustrations will show in detail the distinctive features of this form. It seems more prominent at Rockford than Hackberry Grove, though at stations north and west of Rockford it is much less common than at the brick pits. This is, I think, due to the character of the exposure nearly as much as to irregular distribution of the form.

SPIRIFER WHITNEYI productus nov. mutant.

In general details of structure, number and arrangement of plications and character of sinus this form would not differ from the typical species in description. The number of plications is occasionally larger on either side of the sinus and mesial fold, and they have coarser character than in typical specimens from the Spirifer beds. The important point of difference, however, rests in the fact that the form assumes a very decidedly mucronate character, with a correspondingly greater width as compared with the length of the shell, and much greater length of area in proportion to its height. This characteristic, while by no means lacking prominence is very unstable in the extent of its development, and it is not uncommon to find one tip produced far more than the other, and it is such a

specimen that I have selected for the type of this mutant. In the holotype the sinus and mesial fold are very prominently developed, the beak of the ventral valve is quite strongly curved, and the specimen somewhat damaged. The real distinguishing point of this form is its mucronate character of growth, which is very characteristic.

Holotype:—Number 451, collection of C. L. Fenton. Spirifer zone, pits of Rockford Brick and Tile Company, Rockford, Iowa.

In this same connection I think it advisable to republish the description of a new genus and species of gasteropod, described by Clement L. Webster on pages 39 and 40 of Volume I of the "Iowa Naturalist" (April, 1905).

FLOYDIA Nov. Gen.¹

"Shell large and thick; spire high, or low with volutions partially enrolled upon themselves; volutions rounded, inflated, or somewhat angular or flattened on the side, especially the body volution; volutions four to six; suture strong and deep. Aparture large, generally subcircular to subovate; umbilicus closed; inner or columella lip much thickened and generally flattened; outer lip usually simple. The upper one-fourth to one-half of the first, and generally the second, volution marked by regular, heavy folds, which arch obliquely back and then forward from the suture. Surface of the volutions usually marked by transversely oblique, more or less strong striae of wrinkles of growth.

"The description of this genus is based upon the species *Floydia concentrica* of this paper

Floydia concentrica nov. spec.

"This species has been quite fully described in delineating the genus.

"The shell varies somewhat both in the young and adult form. In the young stage the heavy folds are present only on the upper portion of the body volutions; the upper surface of the body volutions in the low spire variety is sometimes much flattened; the form of the first whorl in the young stage varies somewhat in

¹ This genus was originally described as "Floyda." This was, however, incorrect, and the spelling "Floydia" is here used with Webster's approval.

different individuals. In every case the specimens of this species are prominently marked, by heavy folds on the upper part of the first volution in older forms. The young specimens all occur in the form of casts.

"This species is related more or less closely to *Naticopsis gigantea* of Hall and Whitfield, with which it is associated. Certain partially crushed and distorted individuals of *Naticopsis gigantea* might under certain circumstances be mistaken for this species.

"Position and locality. The forms here described were secured from the Middle Beds of the Hackberry Group of the Iowa Devonian, at Rockford and Hackberry, Iowa; but it doubtless occurs throughout the group at this horizon. Now in the author's collection."

This form was originally described as a variety of *Naticopsis gigantea* Hall and Whitfield. (See 23d. Annual, N. Y. State Cabinet, pp. 238-9, plate 12.) I am quite fully convinced that this form does not belong to the true *Naticopsis*. Whether the generic differences are so great as to place *Floydia* in separate generic rank is not yet fully decided by some. For the present I do so, though it is true that the two forms seem to intergrade.

Mr. Webster wishes to correct the horizon as given for this species. It also occurs in the Owen sub-stage.

In the accompanying plate there are shown four specimens from my own collection. Number one is an individual that has some of the characteristics of both *Floydia* and *Naticopsis*; two is a small specimen of *Naticopsis gigantea* Hall and Whitfield, and three is a moderate-sized specimen of the same species. (888,889, and 120, collection of C. L. Fenton). Number four (No. 40, C. L. F.) is the type of *Floydia concentrica multisinuata* of this paper, and number five is a metatype of *Floydia concentrica* Webster (No. 95, C. L. F.)

In the second specimen the extreme thickness of the shell will be noted together with the three tiny folds near the outer lip. The third specimen shows plainly the lines of growth and the "strong, subregular, transverse folds or wrinkles" of the true *Naticopsis gigantea*, and comparison with *Floydia concentrica* shows them to be of very different character from those of the latter species. Figure 5a shows a cross section of the shell of the specimen illustrated in Figure 5. These figures will, I think, make more plain than words the differences between *Naticopsis* and *Floydia*.

FLOYDIA CONCENTRICA **multisinuata** nov. var.

Shell large and fairly thick except on the upper and outer parts of the body volution, spire high, volutions somewhat angular, particularly the body volution; volutions four to six, suture strong but not so deep as in the typical form. Aperture large; columella lip thick and somewhat flattened. Upper two-thirds or more of the body volution, all or nearly all of the second, and apparently much of the third volution marked by regular, deep folds or wrinkles arching abruptly back and then deeply forward from the suture; surface of the volutions marked by rather to very fine lines of growth. Folds of much finer and more pronouncedly delineated character than in the typical species.

This variety is the most distinct of the forms now placed in Webster's *Floydia*, and is the farthest separated from the genus *Naticopsis*. It differs from the typical *Floydia concentrica* in the higher spire, the finer character of the shell. The holotype, as illustrated, shows well the characteristics of the variety.

I have found that *Floydia concentrica* Webster is more numerous in the Rockford district and particularly at the brick pit than it is at Hackberry Grove. I have found comparatively few at the latter locality, while *Naticopsis gigantea* Hall and Whitfield seems more prominent.

Holotype:—Number 40, collection of C. L. Fenton. Pit of Rockford Brick and Tile Company, Rockford, Iowa. Spirifer zone.

EXPLANATION OF PLATE VI.

- Figs. 1-2.—*Atrypa reticularis alta*. Lateral and anterior views of holotype.
 Figs. 3-4.—*Spirifer Whitneyi rockfordensis*. Lateral and anterior view of holotype, posed to show fully the sinus development.
 Figs. 5-6.—*Spirifer Whitneyi productus*. Anterior and pedicle views of holotype.
 Figs. 7-10.—*Spirifer Whitneyi gradatus*. 7, 8, 9, lateral, anterior and pedicle views of three cotypes. 10, Posterior view of specimen shown in fig. 9.
 Figs. 11-17.—*Spirifer cyrtinaformis Helenæ*. 11, 12, 13, anterior, posterior, and lateral views of holotype. 14, enlarged outline of lateral view, showing beak development. 15, posterior view of a paratype. 16, enlarged lateral view of same, and 17 a tracing of the dorsal valve.
 Figs. 18-22.—*Strophonella reversa gravis*. 18, 19, dorsal and lateral views of a regularly formed cotype. 20, 21, 22, dorsal, lateral, and ventral views of a heavy cotype.

Figs. 23-25.—*Douwillina arcuata maxima*. Pedicle (ventral) and lateral views of a large cotype. 25, posterior view of same posed to show irregularity of shell margin.

Figs. 26-31.—*Spirifer orestes Websteri*.

26.—Anterior view of a coarse and somewhat deformed specimen.

27.—Anterior view of a wide and fine specimen.

28-29.—Detail views of shell and sinus of another cotype.

30.—Enlarged detail of sinus of specimen shown in fig. 27.

31.—Enlarged detail of portion of shell of specimen shown in fig. 26, showing bifurcation of plications.

EXPLANATION OF PLATE VII.

Figs. 1-2a.—Small specimens of *Naticopsis gigantea* Hall and Whitfield.

Fig. 3.—Large and partially restored specimen of *Naticopsis gigantea* Hall and Whitfield.

Fig. 4.—*Floydia concentrica multisinuata*. Holotype.

Fig. 5.—*Floydia concentrica* Webster. 5a, cross section of shell of body volution of specimen shown in fig. 5.

(For further discussion of these figures see under *Floydia concentrica* Webster.)

All figures natural size unless stated otherwise.

Charles City, Iowa.

Heterothrix (B. L. Robbins) Rydb. a Synonym, and Other Notes.

BY J. A. NIEUWLAND.

The name *Heterothrix* Muell., Arg. in Mart. Fl. Bras. VI., 133, t. 40 (1860), antedates the same name used by Rydberg¹ in his "Flora of the Rocky Mountains" for the section *Heterothrix* of Robinson raised to generic standing. To replace the invalidated name may be suggested that of *Pennellia* in honor of Francis W. Pennell.

Pennellia Nwd.

Heterothrix (B. L. Robbins) (1917) Rydb. not *Heterothrix* Muell. l. c., (1860).

Pennellia micrantha (A. Gray) Nwd.

Heterothrix micrantha (A. Gray) Rydb., l. c.

Thelypodium micranthum (A. Gray).

In some instances considerable freedom has been used in changing

¹ Rydberg, P. A., "Flora of the Rocky Mountains and Adjacent Plains." New York, 1917.

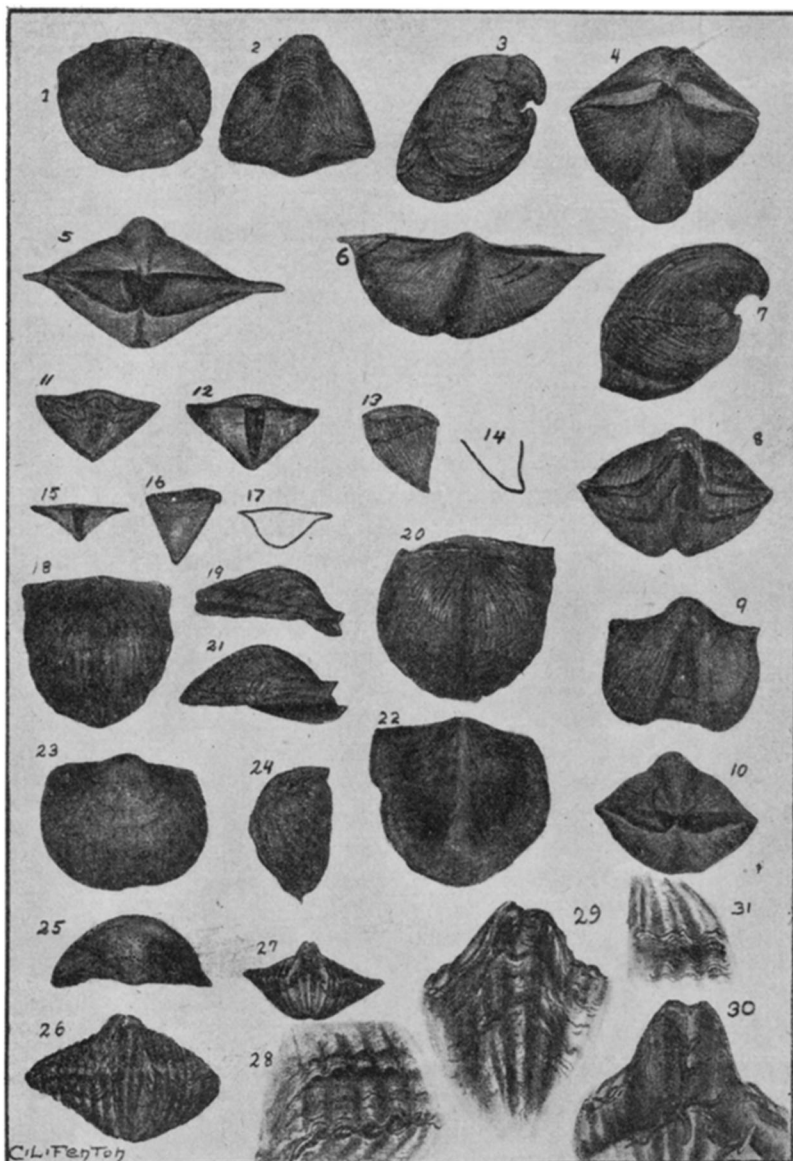


PLATE VI. FENTON ON DEVONIAN BRACHIOPODS

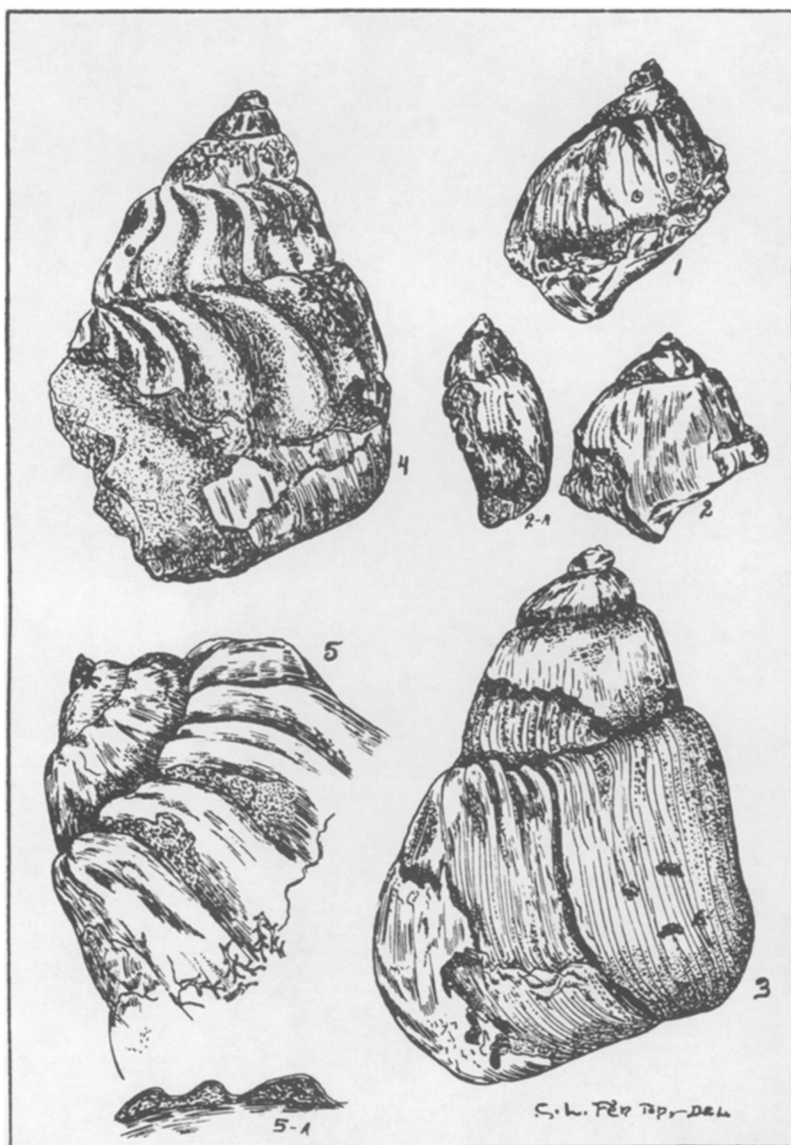


PLATE VII. FENTON ON DEVONIAN GASTROPODS